A diesel mechanic and service technician may opt for ASE certification as a school bus technician. The certification identifies and recognizes those technicians who possess the knowledge and skills required to diagnose, service, and repair different subsystems of Type A, B, C, and D school buses. The ASE School Bus Technician Test Series includes seven certification exams: Body Systems and Special Equipment (S1), Diesel Engines (S2), Drive Train (S3), Brakes (S4), Suspension and Steering (S5), Electrical/Electronic Systems (S6), and Air Conditioning Systems and Controls (S7). Whereas several of these tests parallel existing ASE truck tests, each one is designed to test knowledge of systems specific to school buses. In order to become ASE certified in school bus repair, technicians must pass one or more of the exams and present proof of 2 years of relevant hands-on work experience. Technicians who pass tests S1 through S6, become ASE-Certified Master School Bus Technicians.

The most important work possessions of mechanics and technicians are their handtools. Mechanics and technicians usually provide their own tools, and many experienced workers have thousands of dollars invested in them. Employers typically furnish expensive power tools, computerized engine analyzers, and other diagnostic equipment; but hand tools are ordinarily accumulated with experience.

Experienced mechanics and technicians with leadership ability may advance to shop supervisors or service managers. Mechanics and technicians with sales ability sometimes become sales representatives. Some open their own repair shops.

**Job Outlook**

Employment of diesel mechanics and service technicians is expected to increase about as fast as the average for all occupations through the year 2008. Besides employment growth, opportunities will be created by the need to replace those who retire or transfer to other occupations.

Employment of diesel mechanics and service technicians is expected to grow, as freight transportation by truck increases. Additional trucks will be needed for both local and intercity hauling, due to increased production of goods. Due to the greater durability and economy of the diesel engine relative to the gasoline engine, buses and trucks of all sizes are expected to be increasingly powered by diesels. This will create new jobs for diesel mechanics and service technicians.

Careers as diesel mechanics and service technicians attract many, because of the relatively high wages and the challenge of skilled repair work. Opportunities should be good for persons who complete formal training in diesel mechanics at community and junior colleges and vocational and technical schools, but others without formal training may face competition for entry-level jobs.

Most persons entering this occupation can expect steady work, because changes in economic conditions have little effect on the diesel repair business. During a financial downturn, however, some employers may be reluctant to hire new workers.

**Earnings**

Median hourly earnings of bus and truck mechanics and diesel engine specialists, including incentive pay, were $14.11 in 1998. The middle 50 percent earned between $11.32 and $17.55 an hour. The lowest 10 percent earned less than $9.36 and the highest 10 percent earned more than $20.78 an hour. Median hourly earnings in the industries employing the largest number of bus and truck mechanics and diesel engine specialists in 1997 were as follows:

| | |
|---|---|
| Local government, except education and hospitals | $16.90 |
| Motor vehicles, parts, and supplies | 14.10 |
| Elementary and secondary schools | 13.00 |
| Trucking and courier services, except air | 12.40 |
| Automotive repair shops | 12.30 |

Beginners usually earn from 50 to 75 percent of the rate of skilled workers and receive increases as they become more skilled, until they reach the rate of a skilled mechanic or service technician.

The majority of mechanics and service technicians work a standard 40-hour week, although some work as many as 70 hours per week, particularly if they are self-employed. A growing number of shops have expanded their hours to better perform repairs and routine service when needed, or as a convenience to customers. Those employed by truck and bus firms providing service around the clock may work evenings, nights, and weekends. These technicians usually receive a higher rate of pay for working non-traditional hours.

Many diesel mechanics and service technicians are members of labor unions, including the International Association of Machinists and Aerospace Workers; the Amalgamated Transit Union; the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America; the Transport Workers Union of America; the Sheet Metal Workers' International Association; and the International Brotherhood of Teamsters.

**Related Occupations**

Diesel mechanics and service technicians repair trucks, buses, and other diesel-powered equipment. Related mechanic and technician occupations include aircraft mechanics, automotive mechanics and service technicians, boat engine mechanics, farm equipment mechanics, and mobile heavy equipment mechanics.

**Sources of Additional Information**

More details about work opportunities for diesel mechanics and service technicians may be obtained from local employers such as trucking companies, truck dealers, or bus lines; locals of the unions previously mentioned; and local offices of your State employment service. Local State employment service offices also may have information about training programs. State boards of postsecondary career schools also have information on licensed schools with training programs for diesel mechanics and service technicians.

For general information about a career as a diesel mechanic or service technician, write:

☛ American Trucking Associations, Inc., Maintenance Council, 2200 Mill Rd., Alexandria, VA 22314-4677.

☛ Kenworth Truck Company, Service Coordinator, 700 East Gate Dr., Suite 325, Mt. Laurel, NJ 08054.

☛ Detroit Diesel, Personnel Director, MS B39, 13400 West Outer Dr., Detroit, MI 48239.

Information on how to become a certified medium/heavy-duty diesel mechanic or bus mechanic is available from:

☛ ASE, 13505 Dulles Technology Dr., Herndon, VA 20171-3421. Internet: **http://www.asecert.org**

For a directory of accredited private trade and technical schools with training programs for diesel mechanics and service technicians, contact:

☛Accrediting Commission of Career Schools and Colleges of Technology, 2101 Wilson Blvd., Suite 302, Arlington, VA 22201.

☛ National Automotive Technicians Education Foundation, 13505 Dulles Technology Dr., Herndon, VA 20171-3421.
Internet: **http://www.natef.org**

For a directory of public training programs for diesel mechanics and service technicians, contact:

☛ SkillsUSA-VICA, P.O. Box 3000, 1401 James Monroe Hwy., Leesburg, VA 22075. Telephone: (toll free): 1-800-321-VICA.
Internet: **http://www.skillsusa.org**

# Farm Equipment Mechanics

(O*NET 85321)

**Significant Points**

- Skill in using computerized diagnostic equipment is becoming more important.
- Opportunities should be best for persons who complete post secondary programs in farm equipment or diesel mechanics.
- Jobs are concentrated in small towns and rural areas.

**Nature of the Work**

Many of today's farms use more sophisticated equipment and advanced business practices than ever before. On average, farms have become larger—although fewer in number—allowing the economical use of specialized farm equipment to increase crop yields even while employing fewer and fewer workers. Specialized farm machinery has grown in size, complexity, and variety, and does everything from tilling the land to milking the cows. To operate efficiently, many farms have several tractors equipped with 40- to 400-horsepower engines. Planters, tillers, fertilizer spreaders, and spray and irrigation equipment help grow the crops and combines, hay balers, swathers, and crop drying equipment aid in harvesting them.

Farm equipment dealers employ most of the farm equipment mechanics. Often called service technicians, these workers service, maintain, and repair farm equipment as well as smaller lawn and garden tractors sold to suburban homeowners. What was typically a general repairer's job around the farm has evolved into a technical career much in demand. Farmers have increasingly turned to farm equipment dealers to service and repair their equipment because the machinery has grown in complexity. Modern equipment uses more electronics and hydraulics making it difficult to perform repairs without some specialized training.

Mechanics work mostly on equipment brought into the shop for repair and adjustment. During planting and harvesting seasons, they may travel to farms to make emergency repairs to minimize delays in farm operations.

Mechanics also perform preventive maintenance on older equipment. Periodically, they test, adjust, clean, and tune engines to keep them in proper working order. The level of service is determined by the difficulty of the problem. In large shops, mechanics usually specialize in certain types of work, such as diesel engine overhaul, hydraulic maintenance, or clutch and transmission repair. Others specialize in certain repairs, such as air-conditioning units often included to cool the cabs of combines and large tractors, or the repair of specific types of equipment such as hay balers. In addition, some mechanics assemble new machinery, do body work, and repair dented or torn sheet metal on tractors or other machinery.

Mechanics use many basic handtools, including wrenches, pliers, hammers, and screwdrivers. They also use precision equipment, such as micrometers and torque wrenches, in addition to welding equipment and power tools to repair broken parts. Increasingly, computerized engine testing equipment, such as dynamometers, engine analysis units, and compression testers, is used to measure engine performance and to find worn piston rings or leaking cylinder valves. Soon, mechanics will have access to computerized diagnostic equipment to monitor and locate malfunctions without turning a wrench.

New technology allows farmers to achieve record crop yields from small plots of land by more precisely tailoring their tillage to accommodate the soil conditions of each. This growing use of site-specific technology or precision farming, as it is known, makes use of the Global Positioning System (GPS), yield monitors, and variable rate applicators. These computerized systems link farmers to satellites and other advanced devices to better monitor their crops and land use. More often than not, farmers rely on their equipment dealer to be their one stop for all repair needs. To better satisfy customer needs, traditional repair shops have begun to service advanced equipment, requiring the mechanic to acquire new skills.


*A farm equipment mechanic works on a combine.*

**Working Conditions**

Commonly, farm equipment mechanics work indoors though some do repairs in the field. Most farm equipment mechanics work in well ventilated, lighted, and heated repair shops, but older shops may not offer these amenities; others may work in the farmer's equipment shed or barn where conditions may not be as ideal as in the mechanic's repair shop. Farm equipment mechanics handle greasy and dirty parts and may stand or lie in awkward positions to repair vehicles and equipment. They often lift heavy parts and tools and handle various agricultural chemicals and solutions. Minor cuts, burns, and bruises are common, but serious accidents can be avoided when the shop is kept clean and orderly and safety practices observed.

As with most agricultural occupations, the hours of work for farm equipment mechanics vary according to the season of the year. During the busy planting and harvesting seasons, mechanics often work 6 or 7 days a week, 10 to 12 hours daily. In slow winter months, however, mechanics may work fewer than 40 hours a week.

**Employment**

Farm equipment mechanics held about 49,000 jobs in 1998. Most mechanics worked in service departments of farm equipment dealers. Others worked in independent repair shops, and in shops on large farms. More than 1 out of 10 farm equipment mechanics was self-employed.

Because nearly every area of the United States has some form of farming, it is common to find farm equipment mechanics employed throughout the country. Employment is concentrated in small towns and rural areas, making this an attractive career choice for people who wish to live away from the big city. However, many mechanics work in the rural fringes of metropolitan areas, so farm equipment mechanics who prefer the conveniences of city life need not live in rural areas.

**Training, Other Qualifications, and Advancement**

Technical training is becoming more important because of the development of more complex farm machinery, and because of recent efforts to standardize skills within the occupation. Employers prefer to hire trainee farm equipment mechanics who have completed a 1- or 2-year post-secondary training program in agricultural or farm mechanics at a vocational school or community college. However, if these programs are not offered, study of diesel mechanics offers a strong background. Programs in industrial maintenance, which focus on hydraulics, electronics, engine repair, and welding, are also good preparation. Mechanics need knowledge of computers, and must have the aptitude to read circuit diagrams and blueprints in order to make complex repairs to electrical systems.

Most farm equipment mechanics enter the occupation as trainees and become proficient in their trade by assisting experienced mechanics. The length of training varies with the helper's aptitude and prior experience. Usually, 2 years of on-the-job training are necessary for a mechanic to do routine types of repair work efficiently. Highly specialized repair and overhaul jobs usually require additional training.

Many farm equipment mechanics enter this occupation through careers in related occupations. For example, they may have experience working as a diesel mechanic, mobile heavy equipment mechanic, or automotive mechanic. Prior experience in farm work also provides a foundation for the skills and training necessary to become a farm equipment mechanic as farm workers often make minor equipment repairs to save repair costs. Similarly, people with military backgrounds in

mechanics have valuable experience and training. Persons who enter from related occupations may start as trainees or helpers, however, they may require less on-the-job training.

Employers look for skilled individuals with the aptitude needed to handle tools and equipment. Occasionally, strength is required to lift, move, or hold heavy parts in place. Difficult repair jobs require problem-solving skills to diagnose the source of the machine's malfunction and choose the correct course of action to fix the problem. The importance of computer skills will increase as many more dealers gain access to computerized diagnostic equipment on a laptop computer. This technology will allow mechanics to simply plug into the farm equipment and do a complete diagnostic check by pushing a button. Experienced mechanics should be able to work independently with minimal supervision.

Farm equipment mechanics may keep abreast of changes in farm equipment technology by going to trade shows, by reading the latest farm equipment literature, and by carefully studying service manuals and analyzing complex diagrams. Many farm equipment mechanics and trainees receive refresher training in short-term programs conducted by farm equipment manufacturers. This is the dealers' way of keeping their employees trained in the latest technology and standards within the industry. A company service representative explains the design, function, and techniques required to repair and maintain new models of farm equipment. In addition, some dealers may send employees to local vocational schools that hold special week-long classes in subjects such as air-conditioning repair or hydraulics. Training courses delivered via satellite and video tapes have become increasingly popular ways to standardize training techniques and to cut expenses needed to reach individual dealers and repair shops.

Mechanics' personal tools are very important to their livelihood. Farm equipment mechanics usually buy their own handtools, although employers furnish power tools and computerized test equipment. Trainee mechanics are expected to accumulate their own tools as they gain experience. Experienced mechanics have thousands of dollars invested in their tools.

Farm equipment mechanics may advance to shop supervisor, service manager, or manager of a farm equipment dealership. Some mechanics open their own repair shops or invest in franchised dealers. A few farm equipment mechanics with strong customer service backgrounds advance to service representatives for farm equipment manufacturers.

**Job Outlook**

Employment of farm equipment mechanics is expected to decline through the year 2008. Most job openings will arise from the need to replace experienced mechanics who retire. Nevertheless, job opportunities should be good for persons who have completed formal training in farm equipment repair, diesel mechanics, or a similar program. Employers of farm equipment mechanics report difficulty finding qualified candidates to fill available positions because people trained to repair farm equipment have the fundamental skills and knowledge to work as mechanics in industries outside agriculture. Many young people with mechanic training prefer to take jobs as automotive mechanics, diesel mechanics, heavy equipment mechanics, or industry machine repairers, all occupations that offer relatively higher earnings and a wider variety of locations in which to work.

Some consolidation of farmland into fewer and larger farms is expected to continue through 2008. Although farmers may need a smaller stock of equipment in the years ahead, they will keep investing in newer, more efficient and more specialized equipment to till greater acreage more productively and profitably. For example, new planting equipment uses electronics to spread seeds more uniformly. Many modern tractors have large, electronically controlled engines, and air-conditioned cabs, and feature advanced transmissions with many speeds. The new machinery is expensive, usually being designed and manufactured to withstand many years of rugged use. However, it requires periodic service and repairs. The increased complexity of such equipment means that trained mechanics will make repairs rather than the farmers.

Sales of smaller lawn and garden equipment constitute a growing share of the business of most farm equipment dealers. Most large manufacturers of farm equipment now offer a line of smaller tractors to sell through their established dealerships. This equipment, however, is designed for easy home service and only requires a mechanic when major repairs are needed.

The agricultural equipment industry experiences periodic declines in sales. Layoffs of mechanics, however, are uncommon because farmers often elect to repair old equipment rather than purchase new equipment.

**Earnings**

Median hourly earnings of farm equipment mechanics in 1998 were $10.94. The middle 50 percent earned between $8.86 and $13.20. The lowest 10 percent earned less than $6.96 and the top 10 percent earned more than $16.01. Most farm equipment mechanics also have the opportunity to work overtime during the planting and harvesting seasons, which generally pays time and one-half.

Very few farm equipment mechanics belong to labor unions, but those who do are members of the International Association of Machinists and Aerospace Workers; the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America; and the International Brotherhood of Teamsters.

**Related Occupations**

Other workers who repair large mobile machinery include aircraft mechanics, automotive mechanics, diesel engine specialists, and mobile heavy equipment mechanics.

**Sources of Additional Information**

Details about work opportunities may be obtained from local farm equipment dealers and local offices of the State employment service. For general information about the occupation, write to:

☛ North American Equipment Dealers Association, 10877 Watson Rd., St. Louis, MO 63127.

# Heating, Air-Conditioning, and Refrigeration Mechanics and Installers

(O*NET 85902A and 85902B)

**Significant Points**

- Opportunities should be very good for mechanics and installers with technical school or formal apprenticeship training.
- Mechanics and installers need a basic understanding of microelectronics because they increasingly install and service equipment with electronic controls.

**Nature of the Work**

What would those living in Chicago do without heating, those in Miami do without air-conditioning, or blood banks in all parts of the country do without refrigeration? Heating and air-conditioning systems control the temperature, humidity, and the total air quality in residential, commercial, industrial, and other buildings. Refrigeration systems make it possible to store and transport food, medicine, and other perishable items. Heating, air-conditioning, and refrigeration mechanics and installers, also called technicians, install, maintain, and repair such systems.

Heating, air-conditioning, and refrigeration systems consist of many mechanical, electrical, and electronic components such as motors, compressors, pumps, fans, ducts, pipes, thermostats, and switches. In central heating systems, for example, a furnace heats air